Implementing CMMI at NASA's Goddard Space Flight Center

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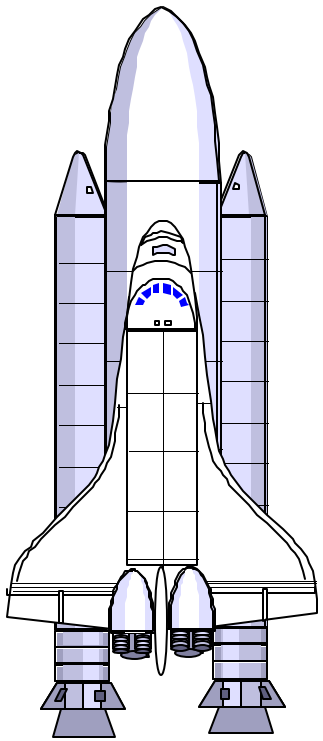
Presentation

NASA's Software Process Improvement Effort

Process Improvement Model for GSFC

Lessons Learned



SWG Establishment

Established by the NASA Policy Document 7120.5 “NASA Software Policies”, 5/98 (Informal existence for > 10 years)

Office of Chief Engineer

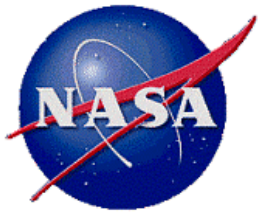
“… to advise the Agency on software related matters and recommend software management, engineering, and assurance policies, standards, best practices and guidance.”

2 FTE’s per Center 1 QA, 1 Development

Linda Rosenberg

Sally Godfrey

SWG Initial Tasks



1 - Define criteria for use of IV&V on a project

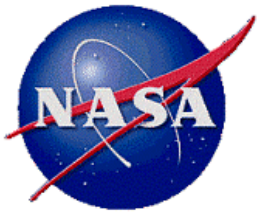
2 - Standards evaluation

- Review IEEE 12207 for potential NASA use
- Review draft of NPG 2820
- Review draft NPD for IV&V

3 - Prepare a plan for improving software process

- **Implementation of software metrics program**
- **Implementation of process improvement model**
- **Establishment of Center Software Engineering Process Groups (SEPG)**

NASA Software Initiative Implementation Plan



Goal: Advance software engineering practices *(development, assurance, and management)* to effectively deliver the scientific and technological objectives of NASA.

Strategies:

1. **Develop and implement Agency-wide and Center plans for continuous software process and product improvement in NASA and Contractor developed software; also establish infrastructure and measurement system**
2. **Improve safety, reliability, and quality of software products through the integration of sound software engineering principles and standards.**
3. Provide input for research based on identified software problem areas and infuse research results
4. Improve software engineering knowledge base in NASA, and implement strategies for attracting, retaining software engineers

SWG Task 3 - Process Improvement Model

Process Improvement Model - which one should be used?

- Capability Maturity Model (CMM)
- Capability Maturity Model - Integrated (CMMI)
- Software Acquisition Capability Maturity Model (SA-CMM)
- Integrated Capability Maturity Model (ICMM) - FAA

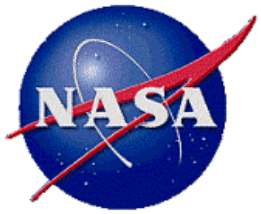
Questions to be answered:

- What is the best approach for Agency implementation?
- What is the cost of implementation?
- Is there Agency funding for start-up training?

Objective - Level 3 equivalence

- Edict by NASA CIO, reiterated by NASA Administrator

SWG Recommendation:



The Software Acquisition CMM is recommended independent of the SW-CMM/CMMI decision for procured software.

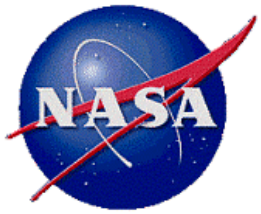
The Software CMM is recommended as the minimum standard for developed software and will be the model against which the Agency will evaluate itself.

The CMM-Integration is a superset of the SW-CMM in that compliance with the CMMI includes compliance with the SW-CMM. The CMMI is recommended for pilot case testing as a future minimum standard by organization(s) that want the added value afforded by the CMMI.

* Excerpt from SWG Subgroup presentation

Goddard Space Flight Center (GSFC)

Software Development Process Improvement Justification



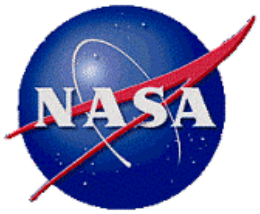
Why are we doing this?

Historically projects are over budget, schedules run late, reliability may be low

CMM has been proven to help these problems*

* Equal or better results expected with CMMI

Recommendation for GSFC SPI by GSFC SWG Contingent



- The CMMI (Capability Maturity Model Integrated) is recommended for implementation across GSFC software developing organizations who have not started CMM implementation.

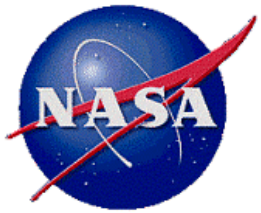
- Justification:

  -CMM is being phased out and will no longer be supported by the SEI (Software Engineering Institute) after 12/2003

  -Development of CMMI is not fully complete and GSFC has the potential to impact technology

  -CMMI combines systems engineering and software development concepts and more closely mimics GSFC development environments

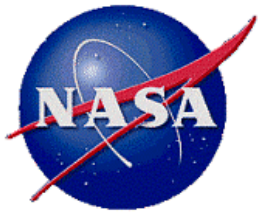
GSFC Software Development Process Improvement



Purpose - improving the processes and practices in use at GSFC using the Capability Maturity Model Integrated (CMMI) levels of maturity (ML) as a measure of progress.

Scope - process improvement effort that will be undertaken with the goal of raising GSFC from its current state to a CMMI Defined maturity level (L3). All projects defined as Mission critical or otherwise identified by GSFC's Center Director will participate in this effort.

GSFC Software Development Process Improvement

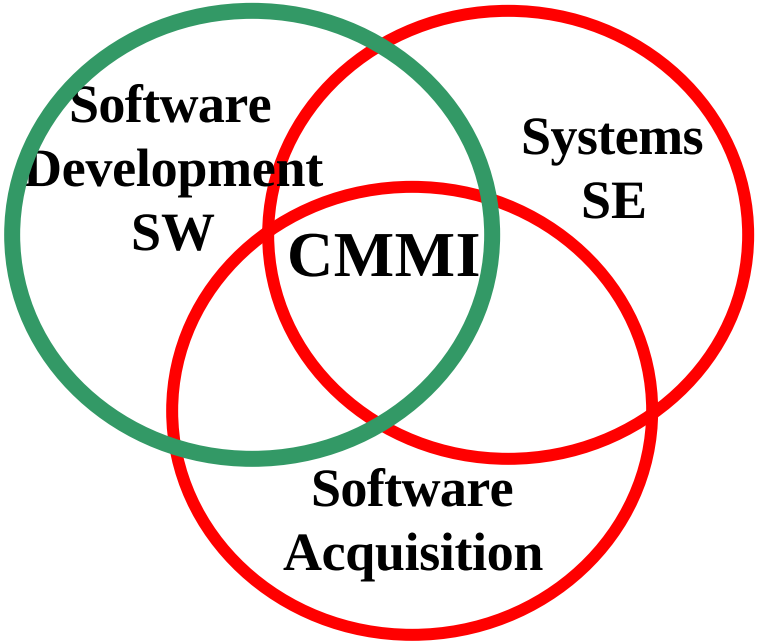


Goals:

- Increase percentage of on-time, within cost software development projects by at least 10%
- Increase productivity by at least 5%
- Decrease cycle time by 10-20%
- Reduce error rate after delivery by at least 20%

In order to measure achievement towards goals, a baseline of the current development status will be needed. Historical data will also be used in building the baseline.

Capability Maturity Model Integrated (CMMI)



GSFC → Current Level = 1

GOAL → Objective Level = 3

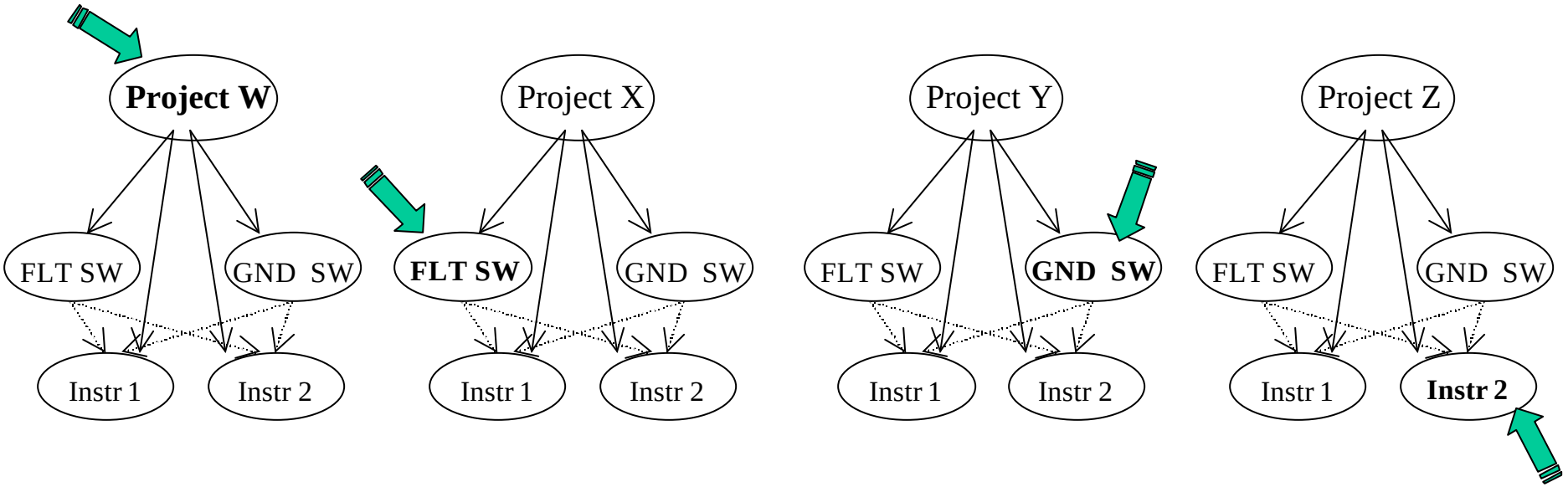
For Pilots:

Emphasis - SW CMM

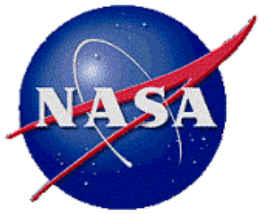
As appropriate - SE CMM

SA CMM

Pilot Project Selection



Implementation Phases

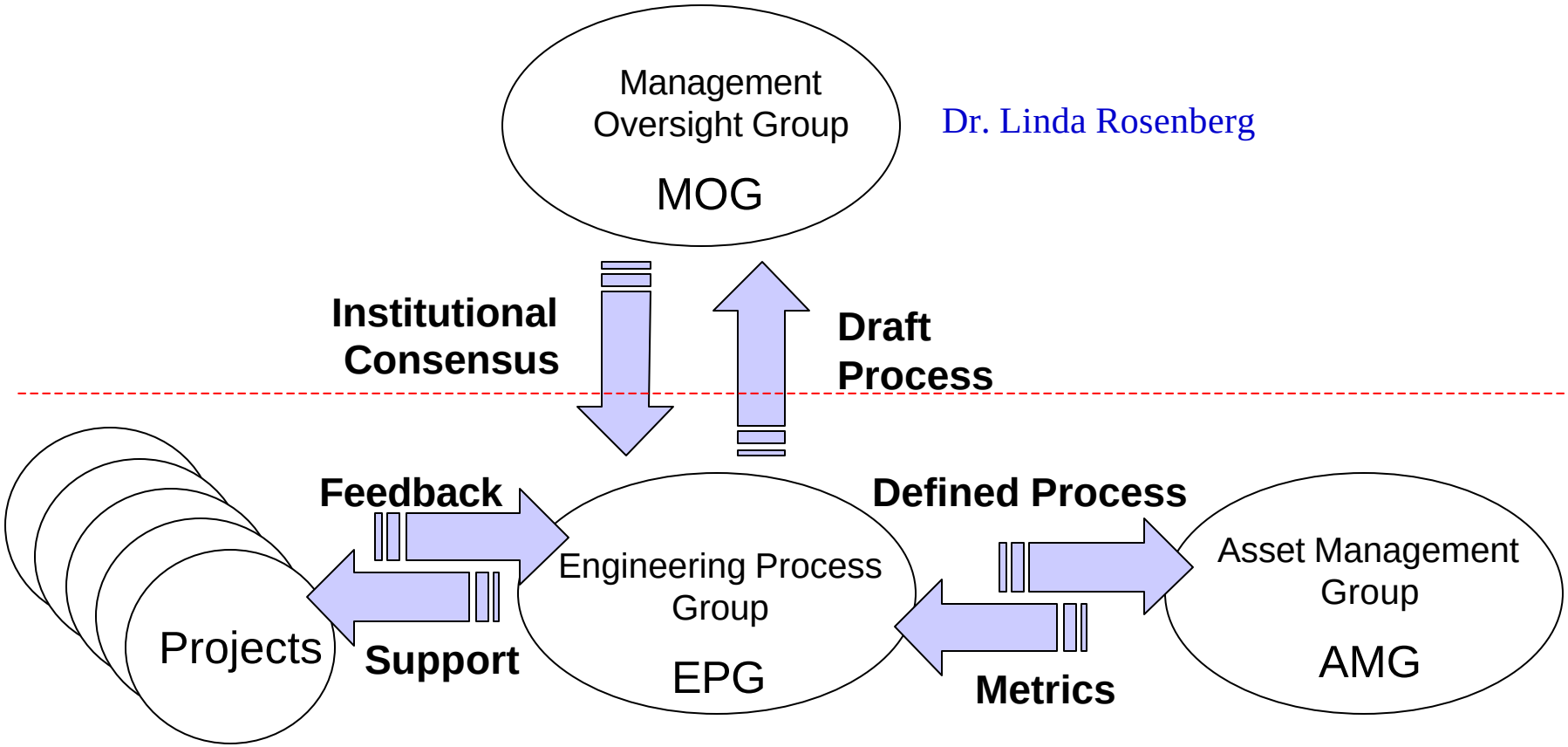


- **Phase 1**: 4 Pilot projects phase to assess the implementation approach of the process improvement effort (1 year effort)

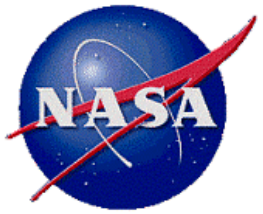
- **Phase 2**: Staged implementation of process improvement effort on all NPG 7120.5 projects with a goal of CMMI Defined maturity level.(L3)

- **Phase 3**: Sustainment and continual improvement of the process improvement gains in the previous phases

Infrastructure



MOG



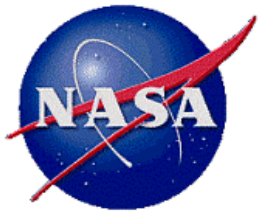
- Provide oversight and direction to the EPG and AMG and assist in establishing priorities
- Work with the EPG in communicating process issues and industry practices to GSFC senior management
- Represent their constituent organizations in reaching consensus on GSFC institutional software policies and standards for both in-house and contractor-supplied software
- Review and concur on all GSFC software and system policies and guidelines prior to final publication

EPG

For the pilots and during the rollout to other GSFC entities the EPG will:

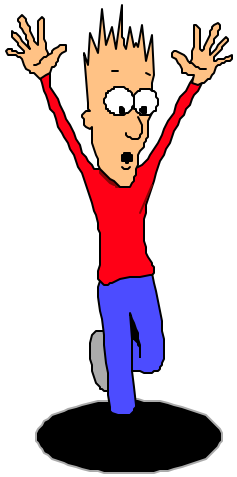
- ✓ Lead the continuous definition, maintenance and improvement of software process policies procedures and best practices including the development and maintenance of the GSFC software development process improvement plan
- ✓ Facilitate software process assessments
- ✓ Arrange for and support training and continuing education related to process improvements for engineers, line managers, project management, and GSFC senior management
- ✓ Define and maintain metrics to track, monitor, and assess the status of focused improvement efforts and pilot studies
- ✓ Provide status information and evaluations of the improvement activities to all levels of management
- ✓ Lead the institutional response, where appropriate, to software/systems-related Nonconformance Reports
- ✓ Maintain a collaborative working relationship with practicing software/systems engineers to obtain, plan, and install new practices and technologies
- ✓ Provide software engineering consultation to development projects and management

AMG

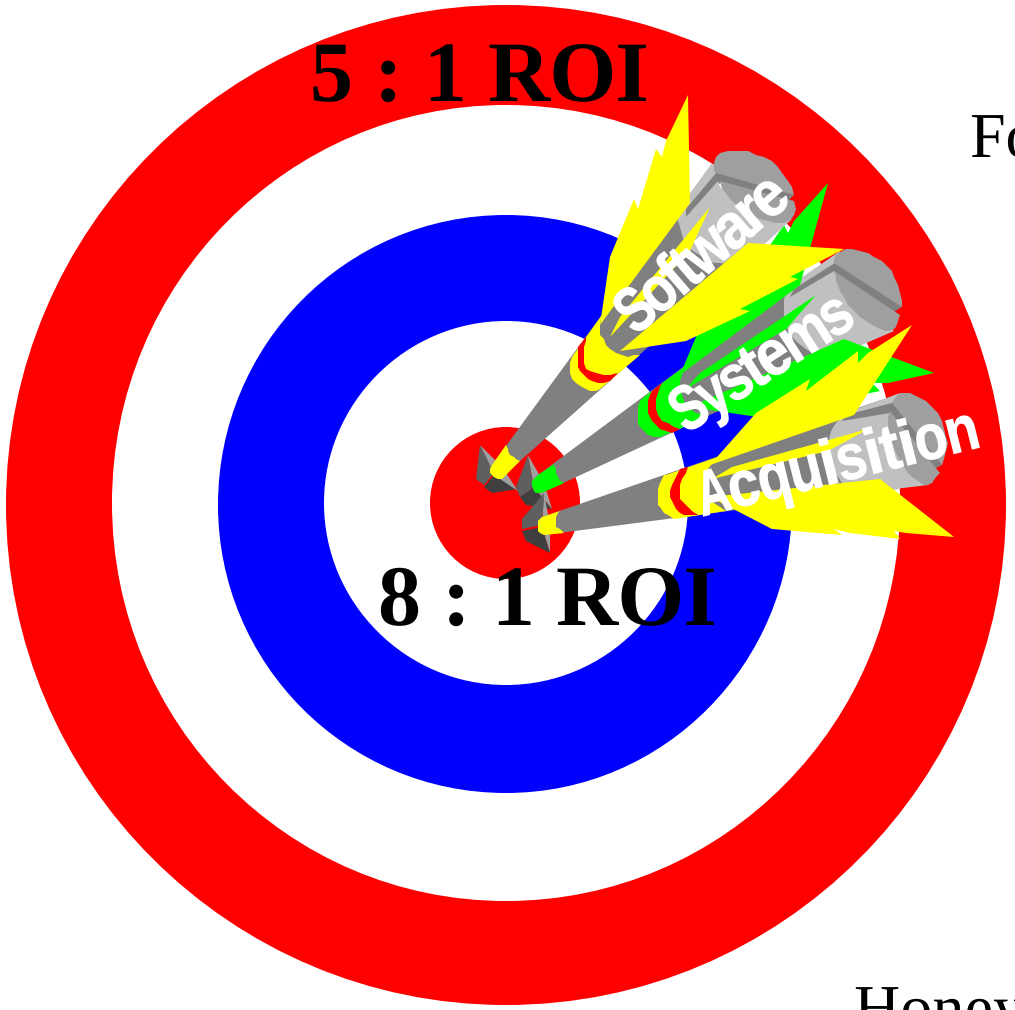


- Develop and maintain the GSFC “Develop Software and Systems Products” web site which includes the software development process improvement library,
- Develop and maintain a database of GSFC software process and product metrics,
- Act as the clearinghouse for software metrics reported to NASA HQ,
- Develop insights into the metrics sources that will enhance the consistency and effectiveness of interpretation,
- Maintain a database of GSFC software product characteristics in order to understand process metrics, encourage software reuse, and assist in identifying special expertise, and
- Establish and manage a service that provides software engineering tools to projects in cases where a single GSFC vendor interface and institutional supplier is appropriate.

Lessons Learned



Return on Investment
5:1 to 8:1



FAA

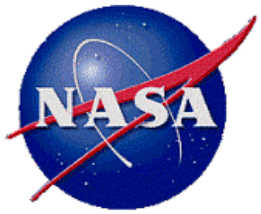
Ford Aerospace

Motorola

AT&T

Honeywell

Return on Investment Industry Definitions / Calculations



Different factors involved

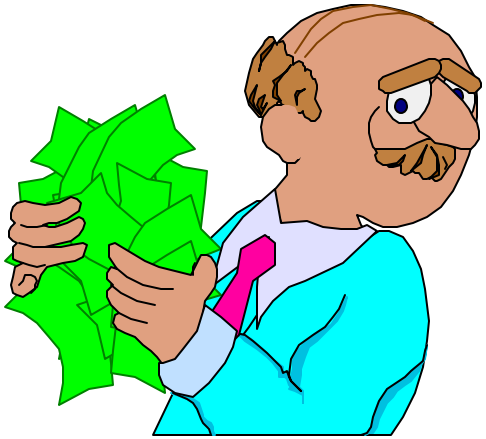
Use different methods

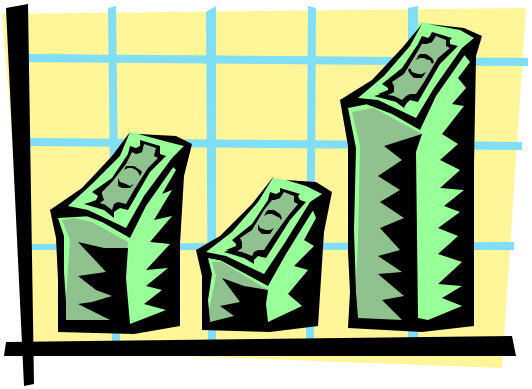
Basic considerations and assumptions similar

Objectives:

- Reduction of development and maintenance costs,
- Improvement of customer satisfaction (defect reduction),
- Reduction of cycle time,
- Increase of profitability, and
- Improvement of professional staff.

Budget Requests

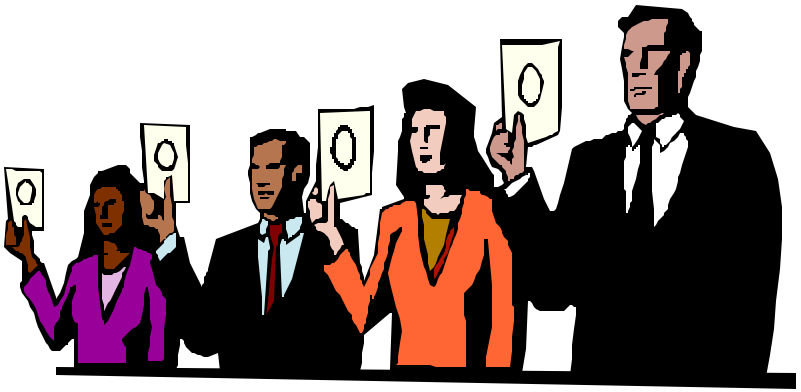


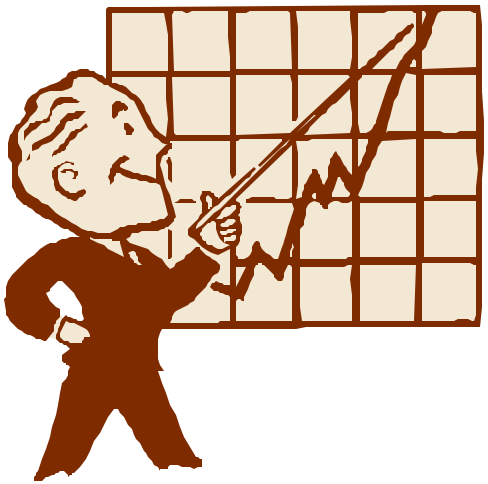


Start early

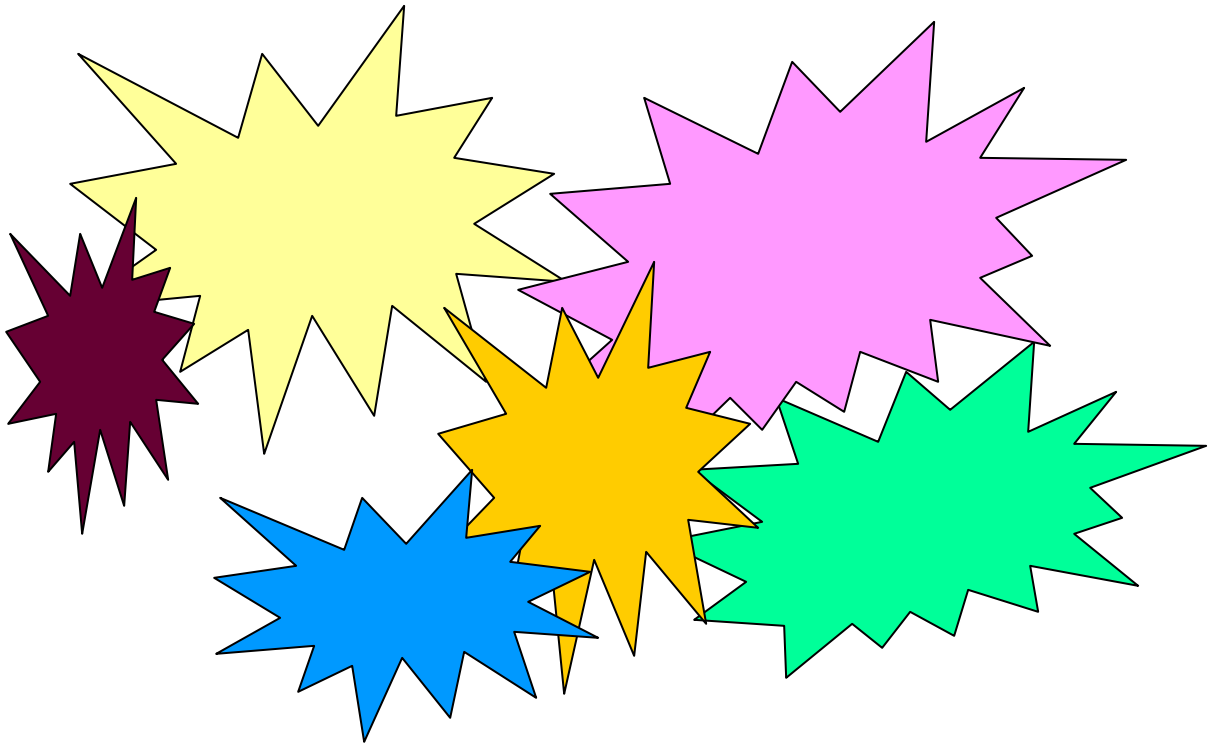
Be realistic

Convince THEM of Value





WHAT is the “Organization”



Same as Always?

Here is Edward Bear, coming downstairs now, bump, bump, bump on the back of his head, behind Christopher Robin.

It is, as far as he knows, the only way of coming downstairs,

but sometimes he feels that there really is another way,

if only he could stop bumping for a moment and think of it.

And then he feels that perhaps there isn't.